SMART

Operational Field Test Evaluation:
Scheduler Survey Report

FINAL REPORT

June 1997

The University of Michigan

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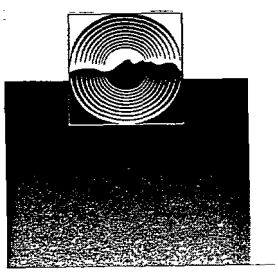

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***This report presents the results of a survey** of SMART's **Community Transit** (paratransit) schedulers as part of the University of **Michigan's evaluation of SMART's ITS Operational Field Test.** This **report** also **is an official deliverable as described in the Statement** of work **for the** evaluation.*

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EXECUTIVE SUMMARY

The Suburban Mobility Authority for Regional Transportation (SMART) has installed an automatic scheduling and dispatch system (ASD) in Southeast Michigan. The purpose of this new system is to improve mobility and increase the efficiency of paratransit services in the region, in addition to addressing national ITS goals. SMART is among the first urban transit systems to implement ITS within its paratransit system before its linehaul system and the first to implement automatic vehicle location within their paratransit operations before their linehaul operations.

As part of their ITS implementation, SMART selected the University of Michigan to evaluate these new systems. This report is one in a collection detailing the results of the UM evaluation of SMART's implementation of advanced public transportation systems (ARTS).

In order to assemble a comprehensive view on the system performance, a number of user groups were interviewed for their reactions to the system supplementing the objective measures addressed elsewhere in the evaluation. This report examines the effect of the scheduling and dispatch system upgrade on the paratransit schedulers within SMART. The University of Michigan evaluators interviewed the schedulers about the new scheduling and dispatch system, addressing the tools that they use during the work day, their interaction with co-workers and others, their expectations for the system, the perceived effects of the new scheduling and dispatch system and their attitudes toward the job. UM staff interviewed the schedulers twice: first before they used the new system to schedule trips and then later after they all had several months of experience with the system.

The findings of this report indicate that the schedulers are generally pleased with the performance of the new software. This opinion was communicated during both sets of interviews. During the initial interviews they were pleased with the initial results and expected the new scheduling system to facilitate their jobs once it was used to schedule all the trips. During the later interviews the schedulers confirmed that the new ASD had made their jobs easier.

The authors would like to thank the Suburban Mobility Authority for Regional Transportation for their support in this report. A special thanks goes to Nikki Carter and David Johnson of SMART for their assistance in arranging the interviews and also to all the schedulers who took the time to share their views with the evaluators during the interviews.

INTRODUCTION

The Suburban Mobility Authority for Regional Transportation (SMART) has recently acquired an automatic scheduling and dispatch system (ASD) to be used within it's paratransit operations. The stated purpose of this implementation is to improve the quality -- efficiency and accuracy -- of paratransit scheduling. The schedulers, who use this new system extensively, participated in the implementation of the software, and now continue to use it to schedule group trips and complicated customer trips. This study is one of three studies, Customer Service Operator Survey, Dispatcher Survey, and Scheduler Survey, addressing the perspectives of SMART personnel on the system upgrade through a similar method. For all three studies, the evaluator relied on individual interviews with the users of the system. Of all the various groups that use the new ASD, the schedulers have the greatest freedom to manipulate the software and are perhaps the group most familiar with it. It is, therefore, essential to include the schedulers in the evaluation of the new ASD. This report provides the schedulers' perspective on the effectiveness of this new software and its effects on SMART paratransit service.

Scheduling and Dispatch System

The overall SMART evaluation, including the findings of this report, addresses the benefits and costs associated with deploying a new scheduling and dispatch system as well as several other components of SMART's new advanced public transportation system (APTS). Scheduling and dispatch is the focus of the Phase One evaluation effort

TRAPEZE™-QV is a network and PC-based scheduling and dispatch system, developed by Trapeze Software Inc. (TSI), that was selected by SMART to be installed as part of the SMART Enterprise Computer System, an ethernet communication system tying together SMART's Macomb, Detroit, Wayne, Oakland, and Pontiac computing sites. TRAPEZE™-QV replaced CARDS as SMART's pure transit scheduling system in Macomb County in early 1995 and was installed for Wayne county and Detroit in late April of 1996. Oakland County had TRAPEZE™-QV installed and was on-line by July of 1996.

According to the TSI product literature, TRAPEZE™-QV provides'real time' demand responsive scheduling and dispatching designed to register potential customers, take customer bookings (subscription, casual), assign the customers to the available vehicles, and dispatch the vehicles and the drivers. The software was designed for a multi-user, microcomputer environment providing real-time dispatch, routing, and scheduling capabilities, allowing transit organizations to streamline their operations, maximize their resources, and improve customer service. The features of TRAPEZE™-QV include (see Appendix C for a complete list):

- Digital mapping functions that check travel times and distances between locations and display vehicle itineraries,
- Customer registration with common destination assignment,
- Booking of requested trips, with trip insertion and closest time rescheduling, and trip cancelling functions,
- Identification and correction of possible service difficulties dynamically, and
- User interface that supports on-line help, edit messages, hot keys, and recall of previously-entered data.

Table 1. Features of CARDS and TRAPEZE™-QV

	CARDS	TRAPEZE™-QV
Application type	Custom designed system to assist in reservation and dispatch system for paratransit scheduling	Real time scheduling and dispatching designed to register potential customers; take customer bookings (subscription, casual), assign the customers to the available vehicles, and dispatch the vehicles and the drivers
Mapping features	None	Street map displays with landmark and location geocoding
Handling of client records	Stores client information in INGRES relational database	Stores client information in spatial database
Booking	Books subscription trips and casual trip requests	Books subscription trips and casual trip requests
Scheduling	Trip insertion and alternate trip times	Trip insertion, alternate trip times, calculates distances by triangulation and routing
Hardware implementation	**VT220** with ethernet connection to VAX VMS	Desktop PCs running Windows '9.5 with ethemet and Novell Schedule and File Servers
Type of user interface	Text based, command driven	Windows '95; Windows NT in the summer of 1997
Vendor	**GIRO**	Trapeze Software Inc.

The move to a new scheduling and dispatch system represented a major upgrade in the computer and communications capabilities of SMART. Before the implementation of TRAPEZE™-QV, the operators used a VAX VMS-based database system called Computer Aided Routing and Dispatch System (CARDS) to schedule paratransit trips. CARDS was designed by GIRO Inc., of Montreal, Canada, and was based on the INGRES relational database. With CARDS, the operators had to determine the most appropriate route and time to place the trip. Since it was up to the operator's discretion and judgment, there was much room for human error. With TRAPEZE™-QV, this margin of error is greatly reduced by having the computer place the trip on the appropriate vehicle at the appropriate time.

METHOD

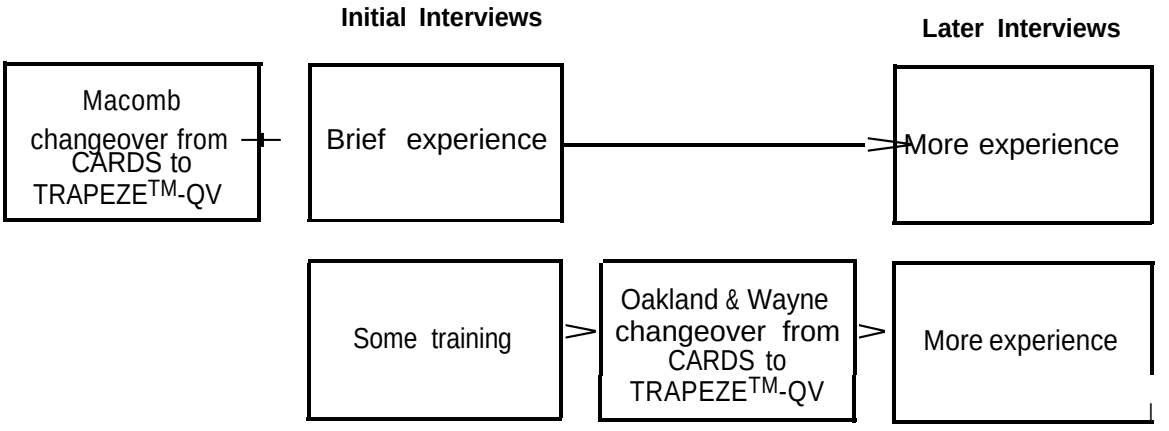
The method used in this study was to interview each schedulers individually, and in depth, after they have had some experience using the scheduling and dispatch product -- TRAPEZE™-QV Individual interviews were selected over focus groups, because the opinions of the individual subjects were most important. Open ended questions probed for the schedulers' opinions, and the reasoning behind their opinions, so that the evaluators could assemble a more complete picture of what contributed to the schedulers' attitudes toward any perceived advantages or disadvantages of the system. Furthermore, because of the relatively small number of subjects (there were six interviews in all) and because of a need for open-ended exploration of the issues, this evaluation study relies on qualitative data analysis. As with the other components of the evaluation, the scheduler evaluation of the system was formulated in light of the contributions expected from the other parts of the comprehensive SMART evaluation; evaluation of quantitative measures are coming from other data collection efforts within the SMART evaluation.

UM evaluators interviewed schedulers on two occasions, once shortly after they began using the new scheduling and dispatch system, and then later, about six months after they had been using the system. Because TRAPEZE™-QV had already been implemented prior to the first data collection effort the evaluation could not follow a comprehensive before-and-after design. However, a longitudinal reporting of scheduler opinions was thought to be useful. In this context it was important to collect data from schedulers who had experience with both CARDS and TRAPEZE™-QV and who could still remember CARDS. It was also important to talk to the schedulers after they had some time to get familiar with the new system, so that they had some time to overcome whatever learning demands were imposed by the new system

The University of Michigan evaluators conducted a total of three interviews at the Oakland terminals in April of 1996, obtaining responses from all three schedulers employed by SMART at that time. All three schedulers were women. The second set of interviews with the schedulers was conducted in December of 1996. At the time of the second set of interviews, the evaluators interviewed three out of the four schedulers; again all of them were women.

The evaluators developed two questionnaires that addressed the schedulers' employment background with SMART, their daily tasks and activities, the tools utilized to accomplish their tasks, and their attitudes toward their jobs in general. Copies of the questionnaires are included in the appendices to this report. Since there are relatively few schedulers employed at SMART, the questions were primarily open-ended to allow for qualitative interpretation of the results. This report addresses several measures of effectiveness (MOEs) from the SMART APTS Operational Field Test Evaluation Plan (August 1995) including percentage of trip requests met, difference between requested and offered trip times, time to make reservations, ease of transfer, number of trip requests, and scheduler's satisfaction.

Figure 1. Longitudinal Survey Design for Schedulers' Opinions



The plan called for interviewing each subject two times, once early after the implementation and once again after they had become more accustomed to using the new scheduling and dispatch system. The two interviews were designed to control for the impact of learning a new system, and in a few cases, to see if there are any changes in attitude before and after the implementation of the new scheduling and dispatch system. This report summarizes and compares the results of the these two sets of interviews.

The interviews were semi-structured and consisted of face-to-face discussions about the system with the selected schedulers. These interviews were arranged with assistance from SMART personnel and they were all conducted at the SMART Oakland terminal in Troy where all the schedulers are located. Interviewers asked a series of questions listed on an interview schedule that followed a set protocol. Each scheduler was interviewed individually by one or two interviewers. The interviewers took careful notes. We conducted a total of six interviews, three during the first set and three during the second set. Due to the turnover rate at SMART, the same individuals were not necessarily interviewed during both sets of interviews. Table 2 displays the number of schedulers interviewed during each set of interviews, the number of schedulers common to both and the number of schedulers only at one of the two sets of interviews.

Table 2. Number of Subjects Interviewed

Subject Groups	First Set of Interviews	Second Set of Interviews
common to Both	2	2
First Set Only	1	–
Second Set Only	–	1
Total Interviewed	3	3
Not participating	0	1

Of the four schedulers interviewed across both sets of interviews, they had been working at SMART for three and a half, eight, eight and a half, and eighteen years respectively, one scheduler had been a scheduler for one year and two other schedulers had been schedulers for four years. The fourth scheduler during the second set of interviews had had the job for only four months at the time of the interview. All of the schedulers had been paratransit drivers and customer service operators before being promoted. Their previous assignments at SMART had allowed the schedulers to learn about the SMART service area.

FINDINGS

The findings are divided into several sections organized by interview set and topic. The first section summarizes the schedulers' opinions from the initial set of interviews in which, in most cases, the respondents were asked to evaluate the systems before the complete installation of the new scheduling and dispatch system. The second section presents the results of the second set of interviews, which were conducted after most of the schedulers had more than six months of experience using the system. Both sections address the schedulers' use of scheduling and dispatch tools and technology, opinions regarding their experience with the current scheduling and dispatch tools, and expectations regarding the systems. The third section presents the schedulers' responses to questions asking them to compare CARDS and TRAPEZE™-QV The fourth section discusses the schedulers' speculations about an ideal reservation system. The final section addresses the schedulers' attitudes toward their jobs. The conclusion compares the initial and later interview responses, and highlights changes in responses between administration of the two sets of questionnaries,

Initial Interviews

AU three paratransit schedulers working for SMART at the time participated in the first set of interviews. At the time, all the schedulers had been exposed to TRAPEZE™-QV though not all were using TRAPEZE™-QV to schedule trips within the area they served. At this time each scheduler was in charge of one of the three counties, Macomb, Oakland and Wayne, within SMART's service area, and scheduled trips only within that county. When asked to list their work duties, the schedulers described the following tasks they must accomplish each day for their respective counties:

- Check schedules for the week, especially the next day, and print out the schedules for the next day.
- Verify that the trip schedules flow well and that the trip sheets are correct.
- Schedule group trips and standing orders.
- Help customer service operators (CSOs) with trips and schedule customer trips that are difficult for the CSOs to schedule.
- Answer customer complaints.

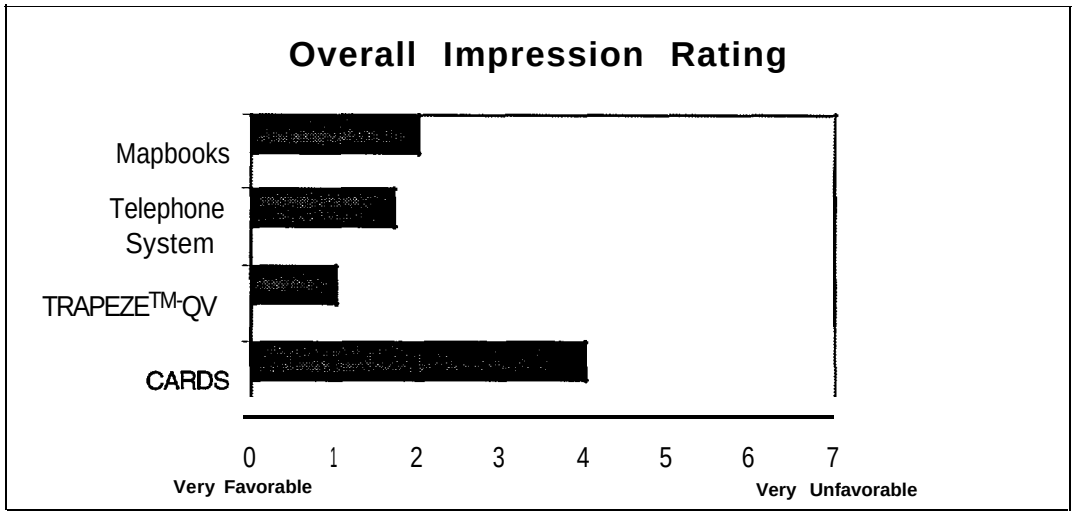
The schedulers provided a detailed description of the process of scheduling a group trip. A group trip consists of five or more people.

1. The trip request generally is faxed to SMART two to four weeks before the trip date. The schedulers ate provided with the number of riders, both in wheelchairs and ambulatory, along with pick up and drop off addresses and times.
2. The scheduler enters the trip information into the computer - pulls up the customer name; indicates the number of passengers; date, time and location of the trip (possibly already in a template); and then inserts the trip into the appropriate block. The buses are scheduled according to the location of the trip.
3. The group trips are scheduled two or three times so that no one else can book any trips on needed vehicles in between trip times.

In addition, no one can schedule a trip twenty minutes before or after the trip. Since the trips are scheduled so far in advance, the schedulers are able to schedule the trips at the group's requested date and time.

The schedulers reported receiving between eight and four hundred group trip requests per month. There are significantly more group requests during the winter months. As long as these trips were reserved at least two weeks in advance, all were accommodated using CARDS. Nearly all were accommodated at the requested time, and a few within thirty minutes of the requested time. All the group trips provide curb-to-curb service from the trip origin to the trip destination with no transfers. The schedulers stated that the entire group reservation process takes fifteen to thirty minutes using CARDS.

Figure 2. Overall Impressions from initial Interviews



The schedulers, at times, have to fill in for the CSOs. When a particular service area is short on CSOs, or if the phones are overwhelming, the schedulers help the CSOs schedule customer trips. The differences between scheduling customer trips and group trips are that the group trip requests need to be faxed in at least two weeks ahead of the trip date, whereas other paratransit customers call two or six days before the trip date (ADA requests can be made two weeks in advance and have priority over all other trips) and group trips are booked twice where-as other customer trips are booked only once.

To accomplish trip scheduling and their other work tasks, the schedulers reported using several tools: TRAPEZE™-QV CARDS, the telephone, and map books. The schedulers evaluated each of these tools for ease of use, effectiveness, satisfaction with use, time to learn, favorite and least favorite features, and overall impression (each dimension rated on a scale from 1 to 7, with 1 being very favorable and 7 being very unfavorable). Figure 2 provides a summary of the schedulers' overall impressions of each tool and Table 3, at the end of the section, provides a detailed descriptive summary of the schedulers' evaluation of each tool. The next few sections describe the schedulers' opinion and evaluation of each tool.

CARDS - Before moving to TRAPEZE™-QV the schedulers used the Computer Aided Reservation and Dispatch System (CARDS) to schedule their paratransit trips. SMART procured CARDS in the late 1980s to help them run a more efficient paratransit scheduling system. In the view of SMART management, CARDS eventually became outdated and has been replaced by TRAPEZE™-QV.

The schedulers reported that CARDS was easy to use and worked to their satisfaction. The schedulers stated that it took them between one day and one week to learn to use CARDS. They mentioned that their favorite feature was booking trips, and that their least favorite was the incorrect information entered into CARDS by CSOs. Their overall impressions of CARDS ranged from 1 to 7, with a mean of 4. One scheduler added that they were pleased that CARDS is on its way out because there is no technical support for CARDS, and no one was available to answer questions or solve problems.

Table 3. Schedulers' Evaluation of their Tools and Technology

	CARDS	TRAPEZE™-QV	Telephone System	MapBooks
Overall impression [a]	4 (n=3)	1 (n=3)	1.7 (n=3)	2 (n=3)
Easy of use	Easy to use	Easy to use	Very easy to use	Easy to use
How well it works	Works well	Works well	Works very well	Works well
Satisfaction with it	Satisfied	Satisfied	Satisfied	Very satisfied
Time to learn to use	One day to one week	A few days	A few days	Immediately
Favorite Feature	Inserting trips	Map	Ability to turn it off and voice mail	References
Least favorite feature	Incorrect information the CSOs put into it	violations	All the phones are connected and they are constantly ringing	Outdatedness and lack of new roads and subdivisions

[a] Rating between 1 and 7 with 1 being very favorable and 7 being very unfavorable.

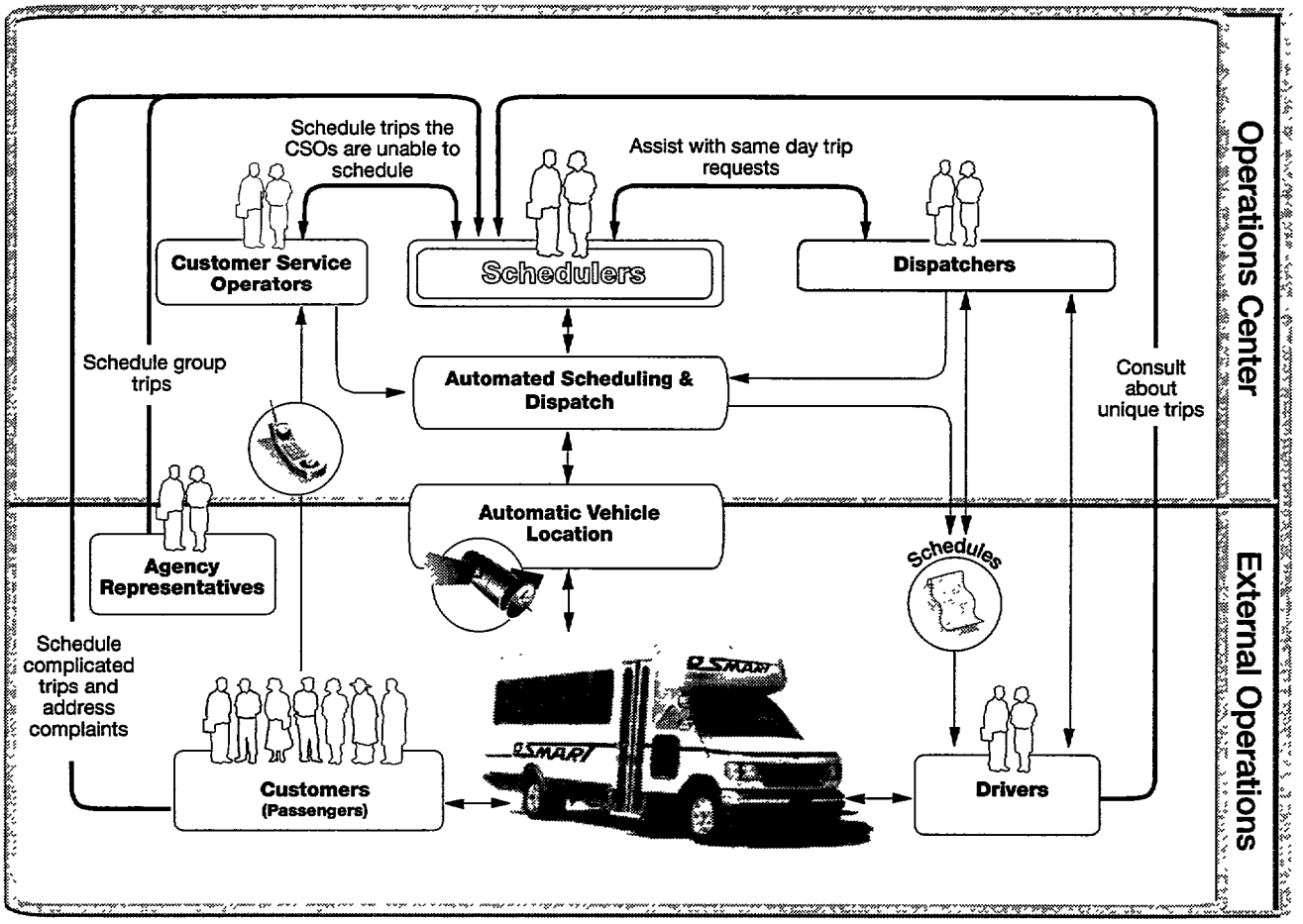
Map Books - A map book is a collection of detailed maps of SMART's service area. The schedulers use the map books to locate addresses they are not familiar with. The schedulers reported that the map books were easy to use and worked to their satisfaction. They stated that it did not take them long to learn to use the map books because they had used them before as drivers and CSOs. Their favorite feature was the reference section (streets, libraries, schools,...) and their least favorite features were its outdatedness and the lack of new roads and subdivisions. Two schedulers gave map books an overall rating of 1, and one scheduler gave an overall rating of 4, resulting in a mean of 2.

Telephone System - The schedulers use the telephone system to communicate with individuals both within and outside SMART. The schedulers reported that the telephone system was easy to use and worked to their satisfaction. The schedulers said that they learned to use the telephone system within a few days. They reported that their favorite features were the ability to turn it off at any time and the voice mail, and their least favorite feature was that all the phones are inter-connected and, therefore, their phones are constantly ringing. Two schedulers gave the telephone system an overall rating of 1 and one scheduler gave it an overall rating of 3, for a mean of 1.7.

TRAPEAE™-QV - Scheduling group trips within TRAPEZE™-QV is similar to scheduling group trips within CARDS. An important difference however, is that the trip is booked only once within TRAPEZE™-QV and no one can book over it. The entire group reservation process takes approximately a few minutes to twenty minutes depending on the size of the group and status of the template (whether one exists or needs to be created). Scheduling the group trips is nearly identical to scheduling individual trips in TRAPEZE™-QV, the difference being that the passenger count must be entered during a group trip reservation.

The schedulers reported that TRAPEZE™-QV was easy to use and worked to their satisfaction. The schedulers stated that they learned to use it within a few days. The schedulers mentioned the map as their favorite feature and the violations (indication of individuals attempting to disregard certain set parameters) as their least favorite feature. The schedulers gave TRAPEZE™-QV an overall rating of 1.

Figure 3. Schedulers' Workplace Interactions



Initially the schedulers stated that nothing regarding their tools needed to be changed. However, one scheduler later added that they needed headsets for the telephones.

Scheduler's Relationship to Others - Figure 3 describes the interaction the schedulers have with individuals both within and outside SMART. Although most of the customers' interaction is with CSOs, periodically a customer will interact with a scheduler. This interaction occurs when a CSO is unable to schedule a trip for a customer, a customer calls to inquire about a group trip, someone has a complaint, or a customer has not shown up for three consecutive trips. During these interactions, schedulers use CARDS, TRAPEZE™-QV, and the telephone system as aids.

The schedulers indicated that they all get along very well with and rely on each other in completing their work tasks. They help the CSOs book complicated trips and deal with difficult clients. The schedulers have received more requests for assistance from the CSOs using TRAPEZE™-QV to schedule trips than from those using CARDS. TRAPEZE™-QV is still relatively new, and the CSOs have worked with it only for a short time. When coming across a violation during the process of scheduling a trip, the CSOs write up the problem and give the trip request to the scheduler to schedule that trip.

The schedulers' interaction with the dispatchers is limited to scheduling last minute trips, reporting trip cancellations, or reporting customers missing buses. This interaction can involve use of CARDS, TRAPEZE™-QV, and the telephone.

The schedulers also have limited interaction with the paratransit drivers. At times, the scheduler has to explain the trip sheets to the drivers. Sometimes when a scheduler needs to insert a trip that typically would not be allowed, the scheduler will confer with the driver before scheduling it. The only tool used during this interaction is the telephone.

Other than the group trips described previously, the schedulers have little interaction with social service agency representatives. The representatives call the schedulers with special requests such as an early pick up or addition of new people to the list of a particular trip. The only tool used in this interaction is the telephone, and sometimes a fax machine.

Expectations of the New Technologies - The schedulers have high expectations for TRAPEZE™-QV They expect the customer trips to be placed in the appropriate slot by the CSOs, unlike CARDS in which any trip can be booked and the scheduler has to rearrange the schedules and fix those trips that are poorly arranged. They anticipate that TRAPEZE™-QV will work well for them and help them with their duties. They, however, do not feel the new automatic vehicle location system will affect them and their work tasks as a scheduler.

Later Interviews

At the time of the second set of interviews, SMART was using TRAPEZE™-QV exclusively for scheduling paratransit trips, and CARDS was no longer being used. During these interviews, three out of the four schedulers at SMART were interviewed. Out of the three schedulers that were interviewed, two had been at SMART as a scheduler long enough to have had experience using both CARDS and TRAPEZE™-QV to schedule paratransit trips. The third scheduler was relatively new and had scheduled only with TRAPEZE™-QV and not with CARDS. Nonetheless, the new scheduler had experience using CARDS as a CSO, though not as a scheduler. The interviews were similar to the first set, only emphasizing the effect of the implementation of TRAPEZE™-QV

The schedulers stated that with the implementation of TRAPEZE™-QV, it takes them less time to schedule a trip and this has made the whole trip booking process more efficient. They believe that the new scheduling system is better than the previous scheduling system.

TRAPEZE™-QV has not affected the tools and technologies the schedulers use during the day. Nevertheless, they mentioned the following desired changes to their current tools: TRAPEZE™-QV needs to indicate the number of customers in wheelchairs scheduled on a single bus at one time, and to provide more information about scheduling violations.

Group Trip Reservation Process Using TRAPEZE™-QV - The group trip reservation process using TRAPEZE™-QV is the same as the reservation process using CARDS, and has not changed since the administration of the first set of interviews.

Interaction with Others - The schedulers indicated that their interaction with individuals, both within and outside SMART, has not changed with the implementation of TRAPEZE™-QV Their interactions with the customers, other schedulers, customer service operators, dispatchers, paratransit drivers, and agency representatives have not changed since the implementation of TRAPEZE™-QV. One scheduler did mention that they now receive fewer requests for assistance from the CSOs. Another scheduler stated that they now receive more requests for assistance, because the CSOs cannot force a trip that causes a violation into the schedule and the schedulers can. Additionally, the implementation of TRAPEZE™-QV has not changed the extent to which schedulers must fill in for CSOs.

Evaluation of TRAPEZ™-QV - In evaluating TRAPEZE™-QV two schedulers found it to be easy to use, while one found it to be very difficult to use. They all found it to work well and to their satisfaction. Two schedulers learned to use the system immediately while the third is still learning to use it after four months as a scheduler.

Favorite features included mouse support and the electronic maps, while the least favorite feature was the violations. The schedulers gave TRAPEZE™-QV overall ratings of 1,2, and 6 (on a scale of 1 to 7, with 1 being very favorable and 7 being very unfavorable), with a mean of 3. While performing either scheduler tasks or CSO tasks, the schedulers preferred TRAPEZE™-QV over CARDS. They found TRAPEZE™-QV to be much easier to use.

Effects of the New Technologies - The schedulers added that the implementation of TRAPEZE™-QV has made their jobs run smoother and easier. They reiterated that they are not sure how the new automatic vehicle location system (AVL) will affect their work tasks, but they believe the new AVL system will help a great deal in tracking the buses.

CARDS versus TRAPEZE™-QV

During the initial set of interviews, the schedulers compared CARDS and TRAPEZE™-QV and stated that CARDS is older technology and slower than TRAPEZE™-QV. They prefer the new screens on TRAPEZE™-QV and find the colorful screens easier to see. One scheduler had no preference for either CARDS or TRAPEZE™-QV, whereas the other two schedulers preferred TRAPEZE™-QV for performing their tasks as a scheduler. When performing CSO tasks, only one scheduler selected TRAPEZE™-QV over CARDS, because TRAPEZE™-QV will not allow infeasible trips to be scheduled. While this should in fact result in more efficient schedules, it interferes with the CSOs goal of scheduling all trips requested. The other two schedulers did not select either system, because the CSOs' computer privileges are limited.

During the second set of interviews, they added that CARDS is easier to manipulate where one cannot manipulate TRAPEZE™-QV. They added that TRAPEZE™-QV has a map in it allowing the scheduler to view the route of the trip and CARDS did not have this feature. The schedulers find the TRAPEZE™-QV screens to be interesting and helpful. They stated that there is a considerable difference between CARDS and TRAPEZE™-QV

Schedulers' Ideal Reservation System

One scheduler described the ideal reservation system to be the system used at the time of the first set of interviews, with both CARDS and TRAPEZE™-QV being used for scheduling. Another scheduler mentioned that they would like to see more access to system functions for the scheduler in TRAPEZE™-QV and would like more training on TRAPEZE™-QV from the appropriate people. This finding suggests a need to reevaluate the employee training process in light of SMART's new technology.

Attitudes Toward Job

At the time of the initial interviews two schedulers did not find their job stressful, while the other found it to be very stressful. However, they all agreed that they had a great deal of job satisfaction and enjoyed their jobs very much

During the later set of interviews, two schedulers found their job to be very stressfnl, while the third did not find it to be stressful. One scheduler is satisfied with the job, another is not satisfied, and the third is not sure.

Initially the schedulers mentioned that the favorite aspects of their job were working with computers, interacting with the public, and scheduling trips, especially creating new group trips. The aspects of their job that they liked the least included helping the CSOs with tasks that schedulers believed CSOs should already know how to do, and a lack of cooperation from management. The schedulers would like to improve their job by changing the room in which they work for a larger room, increasing their pay rate, and increasing their authority.

During the later interviews, schedulers reported that the favorite aspects of their job are rearranging pick ups on the trip sheet (i.e. improving the logic of the schedule) and talking to the customers. Least favorite aspects of the job included telling coworkers

to stop scheduling infeasible trips. Once again, they reiterated that they would like to change some aspects of their jobs, including increasing the size of the work area and receiving more attention from management.

CONCLUSION

Both sets of interviews support the conclusion that the schedulers are satisfied with TRAPEZE™-QV and its effects on their job. Initially they had high expectations of TRAPEZE™-QV and predicted it to facilitate their job. Later interviews confirmed their prediction, and the schedulers reported that TRAPEZE™-QV has made their work tasks easier to perform.

The evaluations of TRAPEZE™-QV from both sets of interviews are similar and the schedulers' positive opinions of TRAPEZE™-QV remained strong. Table 4 summarizes the evaluations of TRAPEZE™-QV both before and after its complete implementation. All the schedulers, except one, had positive opinions of TRAPEZE™-QV, while the third had slightly negative opinion. The scheduler with the slightly negative opinion was a relatively new scheduler, and was still in the learning process at the time of the interview, while the others were a part of the implementation of TRAPEZE™-QV and had considerable experience using it.

The results reveal that the schedulers prefer TRAPEZE™-QV over CARDS. When asked which of the two systems, CARDS or TRAPEZE™-QV, they favored for performing scheduler tasks, initially two of the three schedulers selected TRAPEZE™-QV, while one had no preference. Later, two of the three schedulers stated that they preferred TRAPEZE™-QV over CARDS, while the third scheduler made no comment.

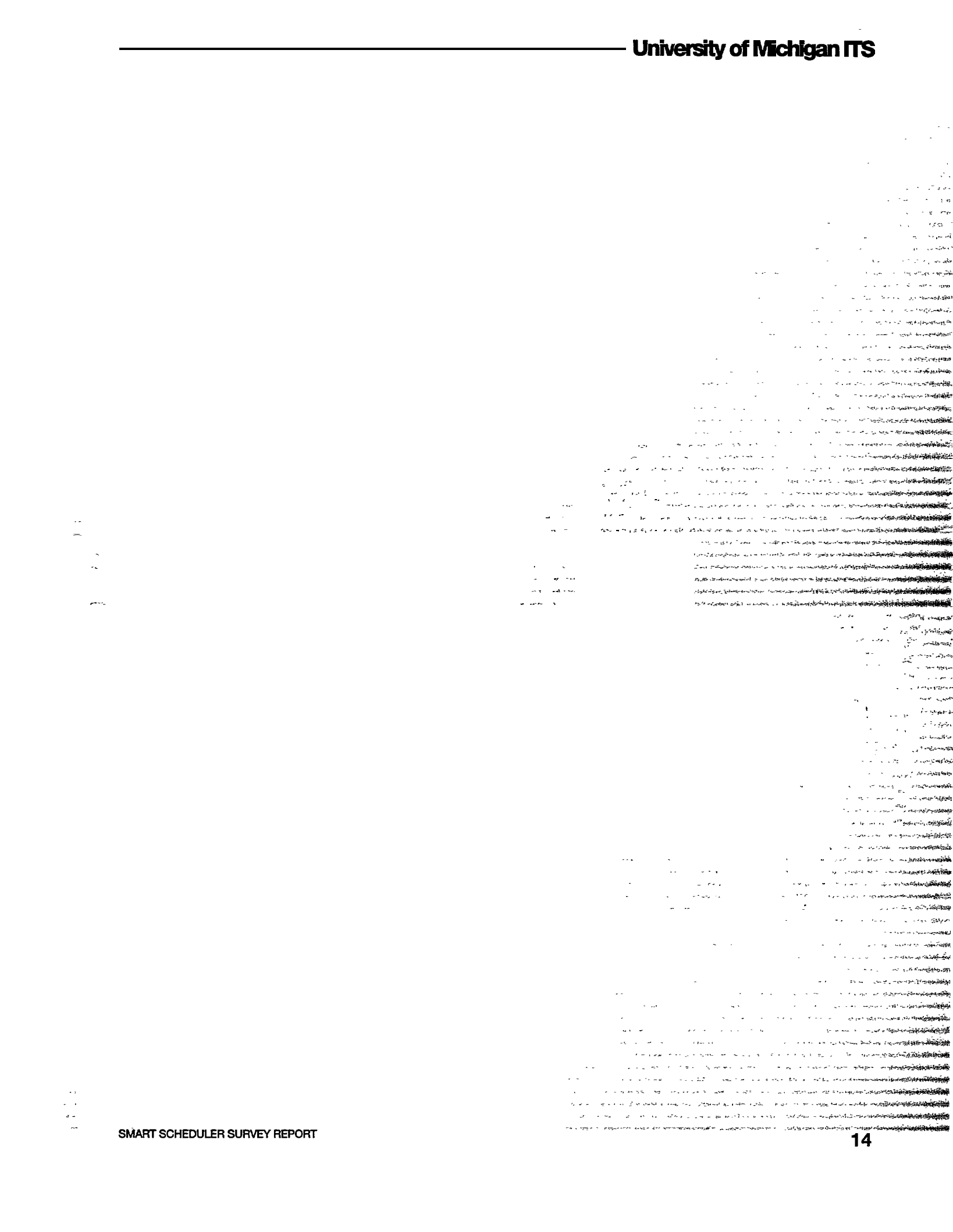
Before the implementation of TRAPEZE™-QV the schedulers had very high expectations of TRAPEZE™-QV and anticipated that TRAPEZE™-QV would work well for them and help them with their duties. When asked about the effects of the new ASD after the implementation of TRAPEZE™-QV the schedulers stated that TRAPEZE™-QV has made their job easier and that paratransit operations run smoother.

Significantly, these findings also help explain differences of opinion between schedulers and CSOs regarding TRAPEZE™-QV Essentially TRAPEZE™-QV provides schedulers with more powerful tools for constructing optimal schedules, while at the same time limiting the freedom of CSOs to force infeasible trips into the system. Therefore, schedulers have gained an added measure of quality control over their work product, while CSOs have lost some freedom to manipulate the trip bookings.

Table 4. Comparing Initial and Later Evaluations of TRAPEZE™-QV

	Initial Interviews	Later Interviews
Easy of use	Easy to Use	Easy to use
How well it works	Works well	Works well
Satisfaction with it	satisfied	Satisfied
Time to learn to use	A few days	Immediately to a few months
Favorite feature	Map	Mouse and the map
Least favorite feature	Violations	violations
Impression a	1 (n=3)	3 (n=3)

Ratings between 1 and 7 with 1 being very favorable and 7 being very unfavorable.



APPENDIX A: Scheduler Initial Questionnaire

Guidelines for Scheduler Interviews

Name of Interviewee: **Names of Interviewers:**

Date:

State the following at the beginning of the interview:

[Give names] We are here from the University of Michigan to conduct a study of SMART paratransit reservation operations and we would like to know what you, as a scheduler, think about it.

This interview will help us understand how technology affects your work. Your cooperation and input will help us enormously.

Your participation in this study is completely voluntary and you may withdraw at any time. You do not have to answer any questions you do not wish to answer or any questions that make you feel uncomfortable. Your comments will remain confidential, and you will remain anonymous in our report. We expect this interview to take approximately 35 minutes. If you have any questions for me/us along the way, please feel free to ask them at any time.

Questions:

1. (A) How long have you been working for SMART?

   (B) How long have you been working as a Scheduler for SMART? ***[What else have you previously done for SMART?]***

   Which service area do you work with?

   (C) How have your previous work experiences helped you in your current position?

2. (A) Describe the tasks that you need to accomplish in a typical workday.

   (B) What tools and technologies do you use to accomplish these tasks? ***[Have them mention specific software (CARDS and Quo Vadis), hardware, phone, paper maps and how they use them. Only Macomb County Schedulers should talk about Quo Vadis]***

   [For each technology and tool mentioned, ask the following:]
   How easy or difficult is _____ to use ?
   How well does _____ work? ***[i.e., performance, ability to get the job done]***
   How satisfied are you with _____ ?
   How long did it take you to feel comfortable using _____ by yourself?
   What is your favorite feature of _____?
   What is your least favorite feature of _____ ?
   Overall, what **is your** impression of _____?
   Very Favorable= 1 2 3 4 5 6 7 =Very Unfavorable

   What would you like to change about your existing tools and techniques?

   How comfortable are you with computers? How would you describe your computer abilities?

   Very Comfortable = 1 2 3 4 5 6 7 =Very Uncomfortable

   (C) How consistent is your work load over the course of the day? week? **and month?**

[Try to get some sense of busy v. slow periods.]

3. (A) Beginning with what happens when your phone rings, could you please describe a typical group trip [e.g., ***Agency representative]*** reservation using the CARDS system?

(B) Typically, how many group trip requests do you receive per day. How many of these trip requests are/were you usually able to accommodate using CARDS? [%]

(C) How many trip requests are/were you able to accommodate at the groups' requested trip time using CARDS? [%]

What is the average difference between requested and offered trip times using CARDS?

(D) How long does a typical group trip request take using CARDS?
[Try to get a sense of how many of these requests are accommodated within the initial phone call versus how many the schedulers have to give a cull back]

(E) How many trips require transfers? [%]

Please describe the process of coordinating transfers across service blocks using CARDS. ***[Try*** to ***get a sense of easy v. difficult and the steps involved.]***

4. (A) We understand that on occasion schedulers fill in for CSOs. When and how often does this occur?

(B) How does the regular customer trip reservation process differ from the group trip reservation process using the CARDS system?

[Questions. 5, 6, 7 and 8 apply only to those schedulers who have had experience using Quo Vadis--Macomb County only.]

5. (A) Beginning with **what** happens when your phone rings, could you please describe a typical group trip ***[e.g. Agency representative]*** reservation using ***Quo Vadis***?

(B) How many group trip requests are you usually able to accommodate using ***Quo Vadis***? [%]

(C) How many trip requests are you able to accommodate at the groups' requested trip time using ***Quo Vadis***? [%]

What is the average difference between requested and offered trip times using ***Quo Vadis***?

(D) How long does a typical group trip request take using ***Quo Vadis***?
[Try to get a sense of how many of these requests are accommodated within the initial phone call versus how many the Schedulers have to give a call back.]

(E) Please describe the process of coordinating transfers across service blocks using ***Quo Vadis.*** ***[Try to get a sense of easy v. difficult and*** the ***steps involved]***

6. How does the regular customer trip reservation process differ from the group trip reservation process using the ***Quo Vadis*** system?

7. (A) In your opinion, what are the differences between CARDS and ***Quo Vadis***? ***[Have them mention Quo Vadis'ability to display map and reservation screens, and its real-time response to customers' requests for trips]***

(B) What do you think about the various ***Quo Vadis*** screens***?*** ***[Have them mention map and reservation screens]***

8. (A) As a Scheduler, which system, ***Quo Vadis*** or CARDS, do you prefer? Why?

(B) ln performing CSO tasks, which system, Quo Vadis or CARDS, do you prefer? Why?

9. Please describe your ideal scheduling and reservation system.
[For questions 10 to I2 , get ***an indication of how much interaction exists]***

10. (A) Other than what you have already mentioned, describe why and how you interact with **customers** as part of your job.

(B) Which of the above mentioned tools and technologies do you use during this interaction? How?

11. (A) Describe why and how you interact with other **schedulers** as part of your job.

Which of the above mentioned tools and technologies do you use during this interaction? How?

(B) Describe why and how you interact with **customer service operators** ***as*** part of ***your*** job ***[Have them discuss the difference between CSO and Scheduler work].***

Which of the above mentioned tools and technologies do you use during this interaction? How?

[For Quo Vadis users]:
In your opinion, do you receive more or less requests for assistance from CSOs who are using Quo Vadis than from those using CARDS?

(C) Describe why and how you interact with **dispatchers** as part of your job.

Which of the above mentioned tools and technologies do you use during this interaction? How?

(D) Describe why and how you interact with **paratransit drivers** as part of your job.

Which of the above mentioned tools and technologies do you use during this interaction? How?

12. (A) Other than what you've already mentioned, describe why **and** how you interact with **agency representatives as part** of your job. ***[Agency reps. are senior centers and the like (e.g., Operation Able).]***

Which of the above mentioned tools and technologies do you **use** during this interaction? How?

(B) Describe why and how you interact with **subcontractors** as part of your job. ***[Subcontractors are Nankin, Mt. Clemens, etc.]***

Which of the above mentioned tools and technologies do you use during this interaction? How?

13. ***[For non-Quo Vadis users]:***

As you probably know, SMART is in the process of adding some new technologies, automatic scheduling and dispatching (Quo Vadis) and automatic vehicle location (AVL) to paratransit operations. How do you expect these new technologies to affect your work ***tasks? [Changes in: ease of job, response time, quality of service and ease of transfers across blocks]***

[For Quo Vadis users]:

As you know, SMART is adding some new technologies, automatic scheduling and dispatching (Quo Vadis) and automatic vehicle location (AVL) to paratransit operations. Now that you have been using Quo Vadis, what are your expectations of these new technologies in terms of their effect on your work tasks? ***[Changes in: ease of job, response time, quality*** *of service and ease of transfers across* ***blocks]***

[Quo Vadis is a 'real time' demand responsive scheduling and dispatching system designed to register clients, take client

bookings, schedule the clients to the available vehicles, and dispatch the vehicles and drivers. AVL provides real time vehicle location through the use of satellites.]

14. How do you feel about your job in terms of job satisfaction and stress? How do you think your coworkers feel about it?

15. What aspects of your job do you like? What is your favorite aspect of your job? What is your least favorite? What would you like to change about your job?

State the following at the end of the interview:

Are there any other questions you would like to ask us or anything else you would like to add? Are there any questions that you believe we have left out during the interview? If you would like to ask any questions or would like to add anything that you can't think of right now, please feel free to call us. ***[Pass along a business card.]***

We may be contacting you in the future for clarification and/or a follow up interview. Thank you very much for your time and input.

APPENDIX B: Scheduler Follow-up Vadis Questionnaire

Guidelines for Scheduler Interviews

Name of Interviewee: Names of Interviewers:

Date: _____

State the following at the beginning of the interview:

[Give names] We are here from the University of Michigan to conduct a study of SMART paratransit reservation operations and we would like to know what you, as a scheduler, think about it.

This interview will help us understand how technology affects your work. We would like to find out what you now think about the technologies you use to do your work. Your cooperation and input will help us enormously.

Your participation in this study is completely voluntary and you may withdraw at any time. You do not have to answer any questions you do not wish to answer or any questions that make you feel uncomfortable. Your comments will remain confidential, and you will remain anonymous in our report. We expect this interview to take approximately 30 minutes. If you have any questions for me/us along the way, please feel free to ask them at any time.

Questions:

1. Which service area do you work with?

2. A. Describe the tasks that you need to accomplish in a typical workday.

   B. How has Quo Vadis changed the tasks you must accomplish during a typical workday?

   C. Has the application of the tools and technologies used to accomplish these tasks changed since the implementation of Quo Vadis? Please describe them and how they have changed. ***[phone, printed schedules. maps...]***

   D. What would you like to change about your existing tools and techniques?

   E. How comfortable are you with computers? How would you describe your computer abilities?

   Very Comfortable =1 2 3 4 5 6 7 =Very Uncomfortable

   F. How consistent is your work load over the course of the day? week? and month?
   [Try to get some sense of busy v. slow periods.]

3. A. Beginning with what happens when your phone rings, could you please describe a typical group tip ***[e.g. Agency representative]*** reservation using Quo Vadis?

   B. How many group trip requests are you usually able to accommodate using Quo Vadis? [%]

   C. How **many** trip requests are you able to accommodate at the groups' requested trip time using Quo Vadis? [%]

   What is the average difference between requested and offered trip times using Quo Vadis?

   D. How long does a typical group trip request take using Quo Vadis? ***[Try to get a sense of how many of*** these ***requests are accommodated within the initial phone call versus how many the Schedulers have to call back.]***

E. With the Quo Vadis system, how many trips require transfers? [%]

Please describe the process of coordinating transfers across service blocks using Quo Vadis. ***[Try to get a sense of easy v. difficult and the steps involved.]***

4. Has your interaction with **customers** as part of your job changed with the implementation of Quo Vadis. How?

5. A. Has your interaction with other **schedulers** as part of your job changed with the implementation of Quo Vadis. How?.

B. Has your interaction with **customer service operators** as part of your job changed with the implementation of Quo Vadis. ***[Have them discuss the difference between CSO and Scheduler work] .*** How?

In your opinion, do you receive more or less requests for assistance from CSOs ***now*** when using Quo Vadis than from before when they were using CARDS?

C. Has your interaction with **dispatchers** as part of your job changed with the implementation of Quo Vadis. How?

D. Has your interaction with **paratransit drivers** as part of your job changed with the implementation of Quo Vadis. How?

6. A. Has your interaction with **agency representatives** as part of your job changed with the implementation of Quo Vadis. ***[Agency reps. are senior centers and the like (e.g., Operation Able).]*** How?

B. Has your interaction with **subcontractors** as part of your job changed with the implementation of ***Quo Vadis. [Subcontractors are Nankin, Mt. Clemens, etc.]*** How?

7. A. We understand that on occasion schedulers fill in for CSOs. When and how often does this occur? Is it more or less frequent with the implementation of Quo Vadis?

B. How does the regular customer trip reservation process differ from the group trip reservation process using the Quo Vadis system?

8. A. In your opinion, what are the differences between ***CARDS*** and ***Quo Vadis***? ***[Have*** them ***mention Quo Vadis' ability to display map and reservation screens, and its real-time response to customers' requests*** *for trips]*

B. What do you think about ***the various Quo Vadis*** screens? ***[Have them mention map and reservation screens]***

C. Which system is better for checking and scheduling a block of work ***[for drivers] ? why?***

9. I would like to get an overall assessment of Quo Vadis.

How easy or difficult is Quo Vadis to use?
How well does Quo Vadis work?[i.e., ***performance, ability to get the job done]***
How satisfied are you with Quo Vadis?
How long did it take you to feel comfortable using Quo Vadis by yourself?
What is your favorite feature of Quo Vadls?
What is your least favorite feature of Quo Vadis?
Overall, what is your impression of Quo Vadis?
Very Favorable= 1 2 3 4 5 6 7 =Very Unfavorable

10. A. As a Scheduler, which system, Quo Vadis or CARDS, do you prefer? Why?

    B. In performing CSO tasks, which system, Quo Vadis or CARDS, do you prefer? Why?

11. Please describe your ideal scheduling and reservation system.

12. As you know, SMART is in the process of adding some new technologies, automatic scheduling and dispatching (Quo Vadis) and automatic vehicle location (AVL) to paratransit operations. Quo Vadis has been installed for a few months already and the AVL system should be installed within the next year. How has ***Quo*** Vadis affected your work tasks? ***[Changes in: ease of job response time, quality of service and ease of transfers across blocks]***

    [Quo Vadis is a 'real time' demand responsive scheduling and dispatching system designed to register clients, take client bookings, schedule the clients to the available vehicles, and dispatch the vehicles and drivers. A VL provides real time vehicle location through the use of satellites.]

    How do you expect the new AVL system to affect your work tasks?

13. How do you feel about your job in terms of job satisfaction and stress? How do you think your coworkers feel about it?

14. What aspects of your job do you like / favorite aspect of your job? What is your least favorite? What would you like to change about your job?

State the following at the end of the interview:

Are there any other questions you would like to ask us or anything else you would like to add? Are there any questions that you believe we have left out during the interview? If you would like to ask any questions or would like to add anything that you can't think of right now, please feel free to call us. ***[Pass along a business card.]***

We may he contacting you in the future for clarification and/or a follow up interview. Thank you very much for your time and input.

APPENDIX C: TRAPEZE^{TM}-QV

The Trapeze Software Group is an innovative developer and supplier of new technology software products for the transportation industry. Our software provides solutions for fixed route, rail, demand - responsive and flexible route operations of virtually any size.

Trapeze Software's products are developed for the microcomputer environment, using new technology programming and database tools. In keeping with the trend toward intelligent transportation systems, our products can be effectively integrated with other systems, including vehicle location, commercial software products and other m-house systems.

Features of Trapeze-QV Mapping

landmark and location geocoding
import interfaces for digitized base maps of your service area
street map displays
calibration and viewing of distances
display / edit zones and map grids

Client Records

storing relevant client information
locating/coding a client on a street map
locating/coding a client in a service area that is not on the street map

Bookings

booking subscription trips and one-time user requests
automatic cancellation/redirection of bookings at the client and location level
check for all bookings that do not return to origin
book unscheduled returns
book any number of days in advance
check bookings while client is on the phone

Scheduling

calculation of distances by xy, triangulation, and routing methods
input of statutory holidays on the calendar to ensure, if necessary, that trips are not scheduled on certain days
viewing of all the trips for a particular client (tabular, calendar)
trip insertion, at request time, onto an existent schedule and view of the effect of the insert on the vehicle itinerary
provision of alternate trip tunes when the requested time cannot be accommodated
global/individual trip modification
vehicle prioritization process
flexible scheduling parameters
selective vehicle availability
batch scheduling
graphical simulation of vehicle routing
provision for trying what if scenarios
save/restore multiple scheduling solutions
match previous solutions from history database
adhere to labor agreement

Dispatching

vehicle profiles by time of day
monitoring of scheduled vehicles by time of day
trip reassignment
redistribution of trips from one vehicle to another
incident capturing
trip cancellation/schedule adjustment

Monitoring (Optional add-on for Vehicle Location Monitoring)

capabilities to determine vehicle position
make logical trip decisions based on vehicle position
schedule adherence

Data Management

complete data integrity at the record and file levels
standard record management system with a report generator
dynamic modification of input format (date, time, distance)
use of special keys to minimize user input
dynamic screen input management feature
forced data values on certain user defined input fields
backup and restore data without leaving the system

Reporting

General unformatted data (locations, clients, schedules, vehicles)
Clients
Locations
Bookings
Vehicle Manifests
Driver Itineraries
Statistical (time & distance)

Interfacing

interfaces for 'off-the-shelf software (e.g. spreadsheets, word processors, desktop publishers)
interfaces for other systems (e.g. MDT's, AVL, etc.)
interface to TRAPEZE™-FX (Trapeze Software's fixed route scheduling system)